SECTION C:
SEPTIC/SEWAGE TANKS

Septic Tank Operation

Additives

Septic Tanks

Tanks for Other Establishments

Tank Construction

Holding Tanks

Tank Maintenance

Septage Disposal

Odors From Tanks

SEPTIC/SEWAGE TANKS

The use of Sewage Tank or Septic Tank is assumed to mean the same tank in this manual.

Septic tanks are used as the primary (first) or only pretreatment step in nearly all onsite systems regardless of daily wastewater flow rate or strength. Other mechanical pretreatment units may be substituted for septic tanks, but even when these are used septic tanks often precede them. The tanks passively provide suspended solids removal, solids storage and digestion, and some peak flow attenuation.

The septic tank is the most commonly used wastewater treatment unit for onsite wastewater systems. The tank provides primary treatment by creating quiescent conditions for anaerobic bacteria inside a covered, watertight vessel, which is buried. In addition to primary treatment, the septic tank stores and its bacteria partially digest settled and floating organic solids in the sludge and scum layers. This can reduce the sludge and scum volumes by as much as 40 %, and it conditions the wastewater by decomposing organic molecules for subsequent treatment in the soil or by other unit processes (Baumann et al., 1978).

Gases generated from digestion of the organics are vented back through the house and out the plumbing stack vent pipe. The inlet tee is designed to limit short circuiting if incoming wastewater across the tank, while outlet tee is designed to retain the scum and sludge in the tank and draw effluent from the clear zone in the middle of the tank depth.

Septic Tank Operation

Sewage Wastes

All of the wastewater from the home must go into the sewage tank. Some early wastewater systems had a separate discharge for “gray water” wastewater that did not include the toilet: typically sink and washing machine water. Gray water is considered sewage water and must be treated with the other wastewaterbecause all gray water contains some amount of solids and FOGs. Do not run laundry wastes directly into a drainfield or any other type of secondary treatment, since soap, detergent scums, or clothing fibers can quickly clog the soil pores or treatment filter, causing failure.

While excessive amounts of any household chemical should not be used, normal amounts of detergents, bleaches, drain cleaners, toilet bowl deodorizers, and other household chemicals can be used and will not harm the bacterial action in the septic tank.

Non-Decomposable Materials

Do not deposit coffee grounds, wet-strength towels, disposable diapers, facial tissues, cigarette butts, feminine hygiene products, and similar non-decomposable materials into the sewage system. These materials will cause a rapid accumulation of solids in the septic tank.

Avoid dumping cooking fats or grease down the drain. These materials may plug sewer pipes or build up in the septic tank and plug the inlet or filter. Keep a separate container for waste grease and discard it separately from the sewage system..

Garbage Disposal Wastes

If a garbage disposal is used, septic tank capacity should be increased by 250 gallons, the minimum Chapter 69 requirement, over that required for dwellings or other establishments without disposals. These septic tanks fill with solids quicker and must also be pumped more frequently than for systems that do not serve garbage disposals. Also, garbage disposals grind materials into fine particles that do not settle quickly out in the septic tank and can pass through the tank into the secondary treatment system.

It is better to compost, incinerate or throw out garbage with the trash. Even though materials like lettuce, carrot tops and potato peelings are organic, they do not break down completely in the septic tank, thus adding volume to the accumulated solids in the tank.

Toilet Tissue

Toilet tissue that breaks up easily when wet should be used. To determine suitable quality tissue, place a portion in a jar half full of water and shake the jar. If the tissue breaks up easily, the product is suitable.

The color of the toilet tissue should have no effect on the septic system as long as the tissue breaks up easily when wet. High wet-strength toilet tissue often causes plugging problems. Many scented toilet tissues are of high wet-strength.

Detergents

Detergents can cause problems with septic systems by disrupting bacterial activity in the tank and treatment system. **People generally use more laundry detergent than is actually needed**. If the automatic washer discharges a large amount of suds after the washing cycle, the amount of washing products should be reduced. Bleach as a laundry additive can cause problems for the system. Bleach is toxic to the bacteria in the septic tank, so excessive use is harmful. One to three cups of bleach per week added to a residential septic system should not be a problem.

Inexpensive powder washing products may contain excessive quantities of filler or carrier, which can be extremely detrimental to the sewage system. The best solution may be to use liquid laundry detergents, since they are less likely to have fillers.

ADDITIVES

Septic tank additives are not recommended. Additives, which include septic tank cleaners, degraders, decomposers, deodorizers, organic digesters, and enhancers, have not proven to significantly improve tank performance. Typical residential and commercial wastewater already contains adequate numbers and types of bacteria, enzymes, yeasts, fungi, and microorganisms that additives are not necessary. . Some of these products can actually interfere with treatment processes, affect biological decomposition of wastes, contribute to system clogging, and contaminate ground water.

Types of additives and effects on treatment processes

There are three general types of commonly marketed septic system additives:

- **Inorganic compounds**, usually strong acids or alkalis, are promoted for their ability to open clogged drains. Product ingredients (e.g., sulfuric acid, lye) are similar to those used in popular commercial drain cleaners. These products can adversely affect biological decomposition processes in the treatment system and cause structural damage to the pipes, septic tanks, has been found to actually degrade soil structure and compromise long-term viability of soil treatment potential. Its use to unclog failed soil absorption fields is no longer recommended.

- **Organic solvents**, often chlorinated hydrocarbons (e.g., methylene chloride, trichloroethylene), are commonly used as degreasers and marketed for their ability to break down oils and grease. Organic solvents represent significant risks to ground water and wastewater treatment processes. These products can destroy resident populations of decomposers and other helpful microorganisms in the treatment system. Use of products containing organic solvents in onsite treatment systems is banned in many states. Introduction of organic solvents into onsite systems located in states that ban the use of these products may trigger liability issues if ground water becomes contaminated.

- **Biological additives,** like bacteria and extracellular enzymes mixed with surfactants or nutrient solutions, do not appear to significantly enhance normal biological decomposition processes in the septic tank. Some biological additives have been found to degrade or dissipate septic tank scum and sludge. However, whether this relatively minor benefit is derived without compromising long-term viability of the soil infiltration system has not been demonstrated conclusively. Some studies suggest that material degraded by additives in the tank contributes to increased loadings of BOD, TSS and other contaminants in the otherwise clarified septic tank effluent.

Other products containing formaldehyde, paraformaldehyde, quaternary ammonia, and zinc sulfate are advertised to control septic odors by killing bacteria. This objective, however, runs counter to the purpose and function of septic tanks (promoting anaerobic bacterial growth). If odor is a problem, the source should be investigated because sewage may be surfacing, a line may be plugged, or another problem might be present.

Septic Tanks

Tank Capacities

Figure C-1 shows the liquid volume of septic tanks as specified in Chapter 69. Liquid volume is calculated by using the surface area and the liquid depth as established to the bottom of the outlet pipe. **Some tank manufacturers provide two tank volumes for a tank, one to the outlet pipe (liquid capacity) and the other to the top of the tank. Care should be taken and not confuse the two values**.

Figure C-1: Septic Tank Capacities for Dwellings (gallons)

number of bedrooms	design flow (gpd)	minimum liquid capacity	liquid capacity with garbage disposal
1-3	450	1,000	1,250
4	600	1,250	1,500
5	750	1,500	1,750
6	900	1,750	2,000
>6		2 x flow	

Chapter 69 requires that septic tanks have two compartments. The first compartment should be two-thirds to one-half of total capacity. The second compartment provides an additional zone for solids to settle out, so that the effluent is relatively clear.

Above the liquid holding capacity additional volume is required in the tank to allow for floating scum storage. The inlet and outlet tee shall be extended at least 6-inches above the liquid level, and 2-inches above the tee to the lid.

For **each** kitchen garbage unit, water softener system, or high volume water use fixture such as a large whirlpool bath, the tank shall be increased in capacity by 250 gallons.

Sewage tanks should be placed so as to be accessible for pumping in all weather conditions. The manhole for the removal of liquids and accumulated solids should be placed in a convenient location and, if buried, the exact location should be measured from permanent fixtures such as the nearest permanent building.

Tanks for Other Establishments

Septic tanks and holding tanks for other establishments (larger flows) have different volume size requirements:

- For flows less than 1,500 gallons per day, the capacity of the tank must be at least 2 times the maximum daily flow.
- For flows greater than 1,500 gallons per day, the capacity must be at least 1,125 gallons plus 75 percent of the maximum design flow. For systems with flows larger than 1,500 gpd, contact the Iowa Department of Natural Resources' Wastewater Section.
- Sufficient detention time or pretreatment must be provided to produce an effluent quality suitable for discharge to a soil treatment system (BOD less than 220 milligrams per liter, TSS less than 65 milligrams per liter, and G & O less than 30 milligrams per liter).
- Holding tanks serving an establishment should provide storage of at least 30 times the average daily design flow (to allow for monthly pumping)

Figure C-2 shows the septic tank capacities for other establishments. For example, if the maximum design flow is 4,000 gpd, use the following formula to calculate tank capacity size:

1,125 + (flow x 0.75) =

1,125 + 0.75 x 4,000 = 1,125 + 3,000 = 4,125 gallons

4,125 gallons is the value shown in Figure C-2.

Figure C-2: Tank Capacities for Other Establishments	
For flows over 1,500 gpd	capacity = (flow x 0.75) + 1,125
2,000	2,625
2,500	3,000
3,000	3,375
4,000	4,125
5,000	4,875

Special Considerations in Tank Design & Sizing

Restaurants
Restaurant wastes typically contain large amounts of cooking fats and greases. For the grease to again coagulate and separate from the liquid as part of the scum layer, both dilution and cooling must take place. High temperature dishwashers, which have internal heaters, may discharge wastewater with temperatures as high as 140 degrees F. Tanks that are in series, and thus in contact with more soil, provide better cooling. (Long, shallow tanks might also provide better cooling than deep tanks).

Septic tank capacities for restaurants should be large enough that the effluent from the tank(s) is of strength similar to that of domestic strength effluent. The BOD of the effluent should be less than 220 milligrams per liter; the TSS should be less than 65 milligrams per liter. Doubling the capacities for tanks shown in Figure C-2 may provide enough capacity; but even larger tanks may be necessary.

Laundromats
Laundromats have the problem of excessive detergent use, along with the lint that is typically discharged with the washwater. In some cases, lint traps have been used effectively to reduce the amount discharged into the septic tank system. It is recommended that septic tank capacities for laundromats be twice the values given in Figure C-2. The outlet baffle must be submerged to 50 or 60 percent of the liquid depth to retain more floating solids. Generally, very little sludge accumulates in the septic tanks of laundromat systems.

Slaughterhouses
Blood has an extremely high BOD, and is therefore very difficult to break down in a septic system. When slaughterhouses have their own onsite system, no blood should be allowed to enter the septic tank. There may be small amounts of blood entering with the cleanup water but the great majority of the blood should be collected and disposed of separately from the sewage system. An engineer should be contacted to design these systems.

Dairies, Milkhouses
Milk solids do not break down under the anaerobic digestion present in a septic tank. Consequently, subsurface disposal fields should not be used with milk wastes. There are a number of ways to dispose of milk wastes if they are kept separate from other wastes.

Filling Stations, Convenience Stores, Car Washes
The oil and grease wastes from a filling station or car wash should not be allowed to flow into a septic system. Such wastes, including floor-washing wastes from the service bay should be discharged into a holding tank, which is pumped and cleaned when full. Only the toilet wastes from a service station should flow into a septic tank and subsurface soil absorption system.

Tank Construction

Figure C-3 defines specifications and C-4 are drawings for septic tanks. Tanks must be watertight from top to bottom, and made of materials that do not corrode or decay. A good installation uses a waterproof mastic compound between the top of the tank and the tank cover and any other joint. Cleaning access extensions should be absolutely watertight, as should the connections for the inlet and outlet pipes.

Figure C-3: Septic Tank Specifications from IAC 567-Ch. 69, 69.5(3-10)

Septic tanks must:

- Be watertight, including at all joints and connections.
- Be placed on level, stable ground that will not settle and is accessible for pumping. Follow the manufacture's instructions on plastic or fiberglass tanks.
- Have at least 2 compartments or be placed in a series. The 1st compartment should be at least ½ the total tank volume, but not greater than 2/3.
- The invert of the inlet shall be at least 2" but not more than 4" higher than the invert of the pipe.
- Inlet and outlet baffles should be 4" schedule 40 sanitary tees or equivalent
  - inlet ≥ 6" above and 8" below the liquid level, but no more than 20% of depth.
  - outlet ≥ above and 10" below the liquid level but no more than 25% of depth.
  - the top of both inlet and outlet tee shall be ≥ 2" from the lid.
- Compartment partition – slots or holes at 1/3 the liquid depth and 8" clearance above the fluid level.
- Pump access openings must be within 12" of finished grade or have a riser installed to within 12" of finished grade.
  - 2 – openings ≥ 18". 1 over the inlet and 1 over the outlet, or
  - 1 – central access ≥ 24" and inspection ports over the inlet and outlet.
- If the riser is at or above the grade it should be secured.
- Have a liquid depth of at least 40" and maximum of 78".
- Be protected against flotation under high water table conditions.
- Have a final cover that is crowned or sloped to shed surface water.

Concrete Tank Specifications

- Maximum water-to-cement ratio of 0.45
- Cement content ≥ 650 lbs/cubic yard
- Minimum compressive strength 4,000 psi at 28 days
- ASTM C150 Type II cement
- Cover reinforcement bars by at least 1”

Tank Thickness Specifications

▪ Poured concrete	6 inches thick
▪ Poured concrete, reinforced	4 inches thick
▪ Special concrete mix, vibrated and reinforced	2.5 inches thick

- Tank bottom same as walls except special cement mix ≥ 3”
- Tank top ≥ 4” with 3/8” rebar on a 6” grid or equivalant
- Cement content ≥ 650 lbs/cy

Fiberglass or plastic tanks wall thickness ≥ 1/4”

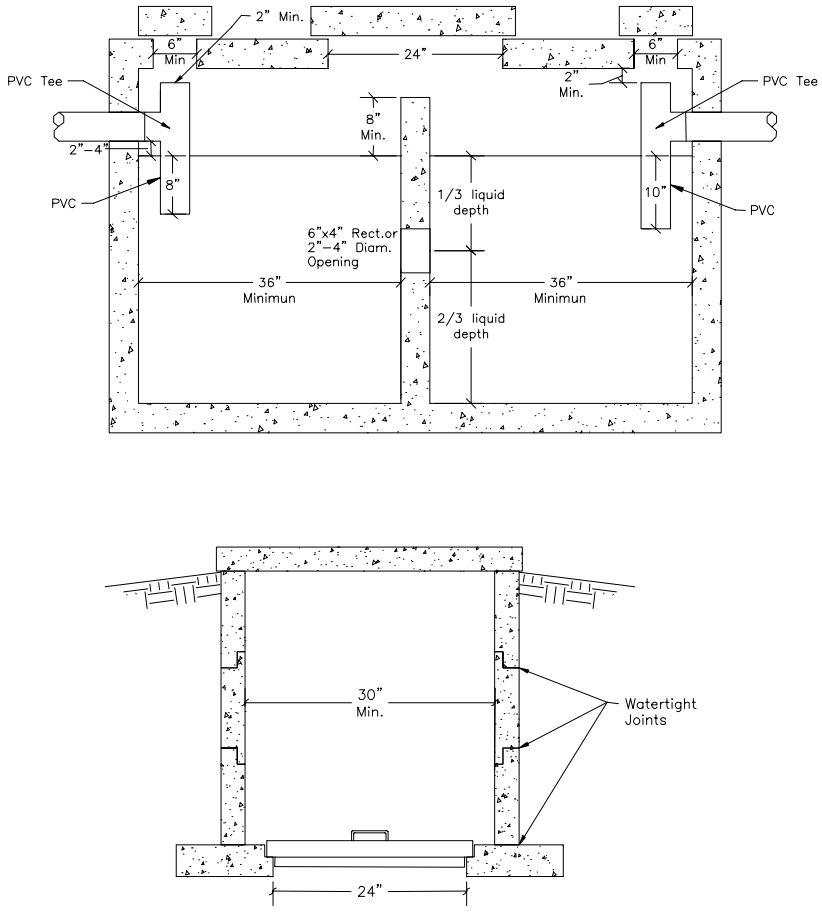


Figure C-4

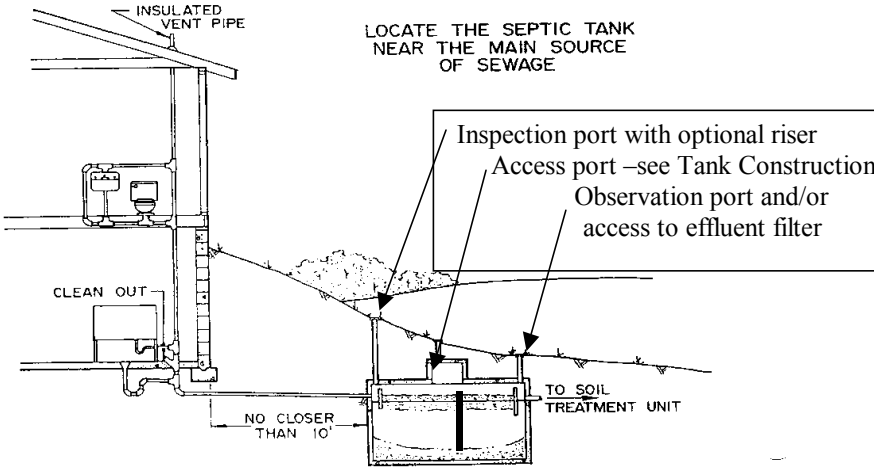
Tank Location

A septic tank should be located near the main source of sewage (usually the house) so the solids settle out with less chance of plugging the line. The tank should also be accessible for the pumper truck to reach the cleanout access hole. The tank should be placed on firm and settled soil capable of bearing the weight of the tank and its contents. Sewage tanks should not be placed in areas subject to flooding.

While a septic tank should be located near the main source of sewage, there are required setback distances for septic tanks, as listed in Figure C-5 and shown in Figure C-6.

Figure C-5: Setbacks Minimum Distance in Feet from Closed Portion of Treatment System	
Private water supply well	50
Public water supply well	200
Groundwater heat pump borehole	50
Lake or Reservoir	50
Stream or Pond	25
Edge of drainage ditch	10
Dwelling or other structure	10
Property lines (unless a mutual easement is signed and recorded)	10
Other type of subsurface treatment system	5
Waterlines continually under pressure	10
Suction waterlines	50
Foundation drains or subsurface tiles	10

Figure C-6



Effluent Screen

Effluent screens (commonly called effluent filters or septic tank filters) which can be fitted to the septic tank outlets, are commonly available (see figure C-7). Screens prevent solids that either are buoyant or are re-suspended from the scum and sludge layers from passing out of the tank. Mesh, slotted screens, and staked plates with openings from 1/32 to 1/8 of an inch are available. Usually the screens can be fitted into the existing outlet tee or retrofitted directly into the outlet. An access port directly above the outlet is required so the screen can be removed for inspection and cleaning.

Quality-assured, reliable test results have not shown conclusively that effluent screens result in effluents with significantly lower suspended solids and BOD concentrations. However, they provide an excellent, low-cost safeguard against neutral-buoyancy solids and high suspended solids in the tank effluent resulting from solids digestion or other upsets. Also, as the effluent screens clog over time, slower draining and flushing of home fixtures may alert homeowners of the need for maintenance before complete blockage occurs.

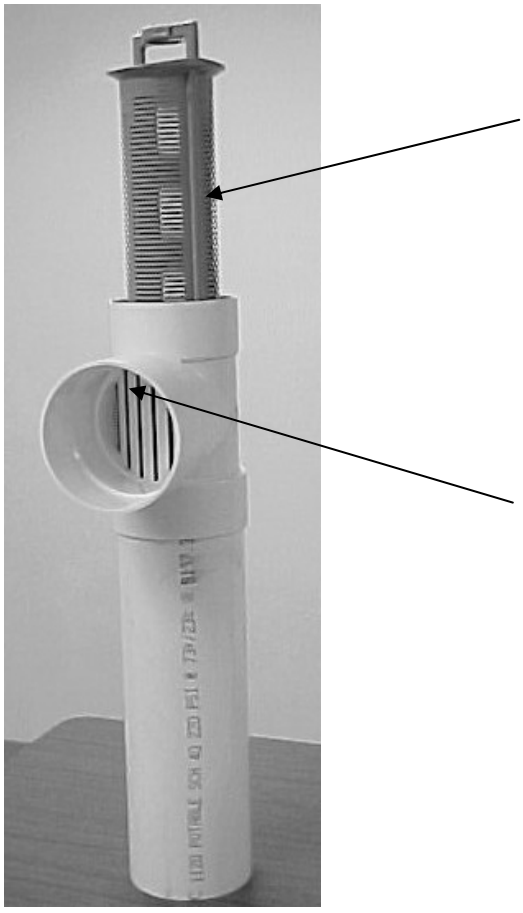


Figure C- 7
Effluent Screens or filters are basically fine plastic screens to prevent solids from passing. There are many sizes, and shapes being used. Some fit right inside the 4" sanitary tee outlet, others are more box shaped, and some have built in protection for when they are pulled out.

Filter tees are manufactured slots across the opening of the sanitary tee in the outlet baffle. This blocks large solids from leaving the tank when the filter is pulled out for cleaning.

Outlet Pipes
Schedule 40 plastic must be used for tank outlet pipes and they must be properly supported between the end of the septic tank and the edge of the excavation so that it will not sag or be broken during backfilling. The soil around the pipe extending from the septic tank must be compacted to original density for a length of three feet beyond the edge of the tank excavation. All penetrations through the septic tank wall must be watertight.

Cleaning Accesses
If the tank cover is more than 12 inches below final grade, cleaning access extensions are needed so that the cleaning access cover is no more than 12 inches below final grade. The cleaning access cover should be secured or have proper soil cover to prevent children or unauthorized individuals from attempting to get into the tank. If the cleaning access is covered with less than six inches of soil, the cover should be secured to prevent unauthorized access. This is for purposes of safety, since the gases in a septic tank may be toxic or cause asphyxiation. There have been instances where people have drowned by falling into septic tanks through improperly protected cleaning accesses.

Inspection Pipes
Inspection pipes must be located over both the inlet and outlet devices. The purpose of the inspection pipes is for checking and cleaning the baffles, effluent filters, and for periodically evaluating the amount of sludge in the tank.

Holding Tanks

Holding tanks are septic tanks with no outlets. These tanks require frequent pumping to dispose of the wastewater when the tank becomes full. Holding tanks are not recommended for typical household installations because of the cost and hassle associated with constant tank pumping. However, there are some situations where a secondary treatment system is not practical or feasible. In some instances, a holding tank may be the only alternative.

Holding tanks are constructed of the same materials and by the same procedures as septic tanks.

Holding tanks may only be installed where it can be conclusively shown that no other options are available and only if the local unit of government allows them to be installed. If holding tanks are approved by the local unit of government, a monitoring and disposal plan must be submitted, signed by the owner and a licensed pumper. The homeowner shall maintain a contract with an approved pumper for disposal and treatment of the sewage wastes.

Holding tanks should only be installed:

- in an area readily accessible to the pump truck under all weather conditions,
- where all separation distances are the same as required for septic tanks, and
- where accidental spillage during pumping will not create a nuisance.

The tank should be protected against flotation under high water table conditions by weight of tank, earth anchors or shallow bury depth.

A cleanout pipe of at least 24 inches diameter shall extend to the ground surface be securely locked to prevent unauthorized entry and be provided with seals to prevent odor and to exclude insects and vermin.

Holding tanks must be monitored to minimize the chance of accidental sewage overflows. A mechanical or electrical alarm must be activated when the tank has reached 75 percent capacity.

Problems with Holding Tanks

- The cost of hauling the sewage can be expensive. Costs of pumping septic tanks are $75.00 to $300.00 for approximately 1,000 gallons. Costs may differ somewhat for holding tanks since they are usually readily accessible. A family of four is likely to generate at least 200 gallons of sewage per day. At a cost of $100 per 1,000 gallons, the annual cost to remove the sewage from a holding tank would be $7,300. Costs will vary with amount of sewage and hauling fees. Water conservation reduces sewage flow and hauling costs.
- The liquid level in the holding tank needs to be continuously monitored in order to prevent an overflow. A high water alarm should be installed.
- Adverse weather conditions or road restrictions may prevent hauling when necessary and require that the plumbing systems not be used until the holding tank has been pumped.
- A continuous contract must be maintained to be sure that pumping service is available and that the sewage can be treated and disposed of properly.
- The high costs associated with routine pumping of a holding tank may increase the likelihood that homeowners will attempt to pump out their own tank and dispose of the contents illegally or hire a local farmer to pump out their tank using liquid manure handling equipment, which results in untreated human wastewater being spread onto farm fields illegally.

Tank Maintenance

See **Appendix A-2: A Homeowner's Responsibilities for Use of an Onsite Sewage Treatment System** for more information about monitoring and maintaining tanks.

Cleaning

Cleaning frequency of a septic tank depends upon tank capacity, the number of people using the system, and appliances such as a garbage disposal. The build-up of solids from one person will, on the average, occupy about 50 gallons of tank capacity per year.

The tank should be cleaned when solids occupy half of the initial liquid capacity (500 gallons of a 1,000-gallon tank). Some tanks may need cleaning within two years or even sooner, while others may go longer before they need cleaning.

Scum and Sludge Accumulations

Scum and sludge accumulations should be periodically evaluated. At least once every three years, the owner of the tank or a septic system professional should inspect the tank and measure the accumulation of sludge.

When to Pump a Tank

The septic tank should be cleaned whenever the top of the sludge layer is closer than 12 inches to the bottom of the outlet baffle, or whenever the bottom of the scum layer is closer than three inches to the bottom of the outlet baffle. Tank capacity and, consequently, detention time is reduced as those solids build up. A tank detention time of much less than 24 hours may result in some solids being discharged with the effluent and carried to the secondary treatment unit. To protect the secondary treatment unit, periodic removal of accumulated solids in the septic tank is necessary.

It is recommended to check the accumulated solids in a new septic tank six months to one year after the tank is put into operation. This early check of accumulation can determine whether building materials (paints, wood, compounds, dirt, etc.) were flushed into the system during construction of the new home. The measurement of the accumulated solids will help to predict the frequency of solids removal needed for system maintenance.

Sludge and Scum Testing

There are two easy methods to check the level of scum and sludge in a tank. The first is with the use of a clear plastic tube about 1 ½-inches in diameter. Open the lid or inspection port and gently insert the tube to the bottom of the tank. Place a stopper in the top and then gently remove the tube. The scum and sludge thickness can be seen through the tube and can be measured directly.

A second method of measuring the scum and sludge level is with a pole wrapped in a white cloth. Gently insert the pole to the bottom. Let the pole sit for several minutes and then gently remove the pole. The scum and sludge will stick to the cloth, so the thicknesses of the scum and sludge layers can be measured. The scum can also be measured by use of pole with a plate attached on the pole, when the plate is raised to the scum level resistance will be felt (see figure C-8).

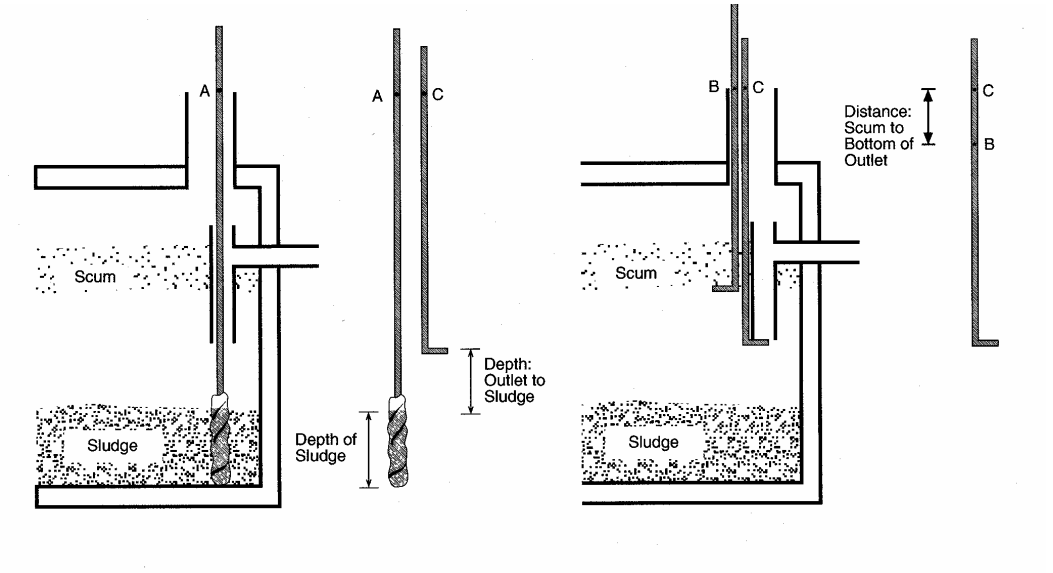


Figure C-8

Tank Cleaning Procedure

Removing all of the septic tank solids involves more than just pumping the tank. When the septic tank is cleaned the cleaning access cover or the tank cover must be removed to facilitate cleaning and to be sure that all solids have been pumped out. A septic tank cannot be cleaned adequately by pumping out liquids through only a four-inch inspection pipe, because the inspection pipe to too small to allow the hose to reach the entire tank interior. This process often results in the scum layer plugging the outlet baffle when liquid again fills the tank. Removal of all sludge, scum, and liquid *must* be done through the maintenance hole. If no maintenance hole exists, one must be installed.

Tank-cleaning can only be conducted by a professional with proper equipment. Some of the liquid is first withdrawn from the tank and then pumped back into the tank under pressure to agitate all the solids into suspension. If the scum layer is hard, it may be necessary to agitate the tank with air or to use a long-handled shovel through the cleaning access in order to break up the scum layer.

When all of the solids have been broken up and are suspended in the liquid, the mixture is pumped out of the septic tank into the truck. Unless the cleaning access is open, it will be virtually impossible to tell if all of the solids have been removed from the tank.

If someone has attempted to service a septic tank through the inspection pipes over the inlet and outlet baffles, those baffles may be broken or dislodged. When the septic tank cleaning access is open, check the condition, length, and submergence of the inlet and outlet baffles. The septic tank service personnel should replace them if they are the wrong length or in poor condition.

It is not necessary to leave solids in the septic tank to “start” it again. Sufficient bacteria remain in the tank and are continually added to the system..

How to Clean Effluent Filters

Do not remove the filter before the tank is pumped. If the filter is plugged scum or sludge may enter the laterals when the filter is removed. After the tank is pumped remove the filter and wash the filter off with the water flowing into the tank, or into a bucket. Then this wash water can be dumped into the septic tank or pumper tank. Follow the manufacturer's instructions at all times.

Septage Disposal

Septage is the term for the wastewater (solids and liquids) pumped out of septic tanks. In Iowa, disposal of septage is subject to the requirements of Iowa Administrative Code 567—Chapter 68, "Commercial Septic Tank Cleaners".

Septage must be removed from septic tanks only by an Iowa-licensed commercial septic tank cleaner or hauler. Commercial septic tank cleaners must pay a yearly license fee (currently $25) to the Iowa DNR License Bureau, 900 East Grand, Des Moines, IA 50319. Each septage hauling vehicle or tank must have the license number displayed and a copy of the current license with the vehicle. Septage haulers must dispose of septage according to Chapter 68 requirements.

There are two primary allowable methods of septage disposal: 1) discharge to a permitted wastewater treatment facility, such as a municipal treatment plant; or 2) land application, by injection or to the ground surface. Chapter 68 also allows for septage disposal to permitted sludge lagoons or sludge drying beds and to permitted sanitary landfills.

Land Application Restrictions

Land application of septage to the ground surface is subject to the following restrictions. Septage applied to the ground surface must be mixed with lime prior to application (see section below for details). The applicator must create and maintain, for 5 years, documentation including location, date, acres, vector reduction used. The maximum application rate is 30,000 gallons of septage per acre per year on cropland. Septage application is not allowed on lawns or home gardens, nor is allowed on food crops (until 38 months after application), or on land used for grazing (until 30 days after application). Septage application is also prohibited on soils classified as sand, loamy sand, silt, or on soils with a pH below 6.0, although agricultural lime may be used to increase the pH to an acceptable level. Chapter 68 places additional restrictions on septage applications on sloping ground, frozen ground, on sites near streams, lakes, sinkholes, tile line, intakes, residences, and wells.

Separation distance restrictions on land application of septage are listed below:

Separation Distances	
Residences	200 feet
Wells	500 feet
*Open Waterway	35 feet

*If septage is applied within 200 feet of a stream, lake, sinkhole or tile line surface intake located down gradient of the land application site, it shall be injected or applied to the surface and mechanically incorporated into the soil within 48 hours of application.

Prohibited sites for land application of septage are listed below:

Prohibited Sites
Soil with pH of 6.0 or less
Slopes greater than 9 percent
Frozen or snow-covered ground on slopes greater than 5 percent
Any frozen or snow-covered sites, unless special runoff precautions are taken

Mixing Lime with Septage

When septage is applied to the ground surface, it is required that it be stabilized by adding and thoroughly mixing 50 pounds of lime with each 1,000 gallons of septage, or by adding and thoroughly mixing sufficient lime to the septage to produce a mixture with a pH of 12. The mixing of lime with septage is not required if septage is injected below the surface of the land or if it is incorporated into the soil within six hours of land spreading. The purpose of these requirements is to reduce pathogens and vector attraction.

Odors from Tanks

Some homes produce noticeable septic odors from the roof vent of the home's plumbing system, and there are several methods for solving odor problems. If the plumbing vent does not extend high enough above the roofline to carry away any gases, odors may be carried downward to the ground in the house or yard area. Two common roof slopes are a four-to-12 pitch (four inches of rise per 12 horizontal inches) and a five-to-12 pitch. For a roof having a four-to-12 pitch, the plumbing vent should extend six feet two inches above the roof or two feet above the ridge.

Another possible solution is to add a filter directly to the roof vent. Filters have successfully eliminated odors from roof vents, according to reports of their use in Iowa and Minnesota.